REMARKS

In connection with the above-identified patent application, the Examiner issued an Office Action dated November 6, 2007 in which the Examiner rejected claims 1-4, 10-12, 15-17, 24-29 and 31. The Examiner objected to claims 15 and 27 for informalities and to claim 30 for duplication. The Examiner rejected claims 1-4, 15-17 and 27-29 under 35 U.S.C. § 103(a) as being unpatentable over United States Patent 6,379,929 to *Burns et al.* in view of United States Published Patent Application 2002/0144738 to *Unger* and further view of United States Patent No. 6,454,547 to *Kohlhaas et al.* and rejected claims 10-12, 24-26 and 31 under 35 U.S.C. § 103(a) as being unpatentable over *Burns et al.* in view of *Unger* in view of *Kohlhaas et al.* further in view of United States Patent No. 5,955,801 to *Romero et al.*

Claims 1-4, 10-12, 15-17 and 24-31 were pending in this application. Claim 30 has been canceled without prejudice, and claims 1-4, 10-12, 15-17, 24-27, 29 and 31 have been amended. In view of the arguments set forth below, claims 1-4, 10-12, 15-17, 24-27, 29 and 31 are allowable, and the Examiner is respectfully requested to withdraw the rejection and issue a Notice of Allowance.

I. CLAIM REJECTION UNDER 35 U.S.C. §103

The Examiner rejected claims 1-4, 15-17 and 27-29 under 35 U.S.C. §103(a) as being anticipated by United States Published Patent 6,379,929 to *Burns et al.* in view of United States Patent Application 2002/0144738 to *Unger* in view of United States Patent No.

6,454,547 to *Kohlhaas et al.* The examiner stated that Burns teaches a micropump device made of a fully monolithic body formed from a single material, specifically silicon (Burns, column 30, lines 38-41), however, Burns fails to teach the specific number of layers use din total thickness of the pump. The examiner also stated the Unger teaches a micropump with specified thickness and a layer number requirement.

The Examiner stated that Kohlhass taught a method of pumping fluids where the pump includes a pumping chamber wherein said pumping chamber includes an inlet and outlet for expelling said fluid of said chamber. The Examiner concluded that it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the monolithic pump of Burns and the pump structure of *Unger* with the pump structure of *Kohlhaas* in order to create a pump with the smallest possible dimensions which can be produced cost effectively.

Burns teaches a heating treatment to amplify the nucleic acid target sequencing in a microfabricated device. The micordevice is made of thermally conducting material (see column 5 lines5-10) it composes channels and chambers, no mechanism of pumping within the structure has been defined. The basic function of the device described in Burn is to heat biological sample in a manner similar to inkjet printer (i.e. using a metallic heating element). He disclosed different pumping functions such as electrowetting, bubble pump, capillary action etc. (Column 8) but failed to disclose mechanical actuation. In the mechanical actuation of fluid the pumping is conducted by a direct contact of a moving structure with the fluid element, such as those disclosed in this application. The channels described in Burns in

the device are treated with a hydrophilicity-enhancing agent (see claim 3), where such treatment is not required in the structures described in this application. *Burns* teaches a reaction chamber (see claim 6) not a pumping chamber, the chamber must include a heating element, made out of thermally conducting element (aluminum) (see column 8 line 60-63) and it requires a liquid barrier such as silicon oxide or silicon nitride, thus the mcirodevice described by Burns to maintain its require function multi-materials ***hence not monolithic***. Independent claims 1, 15 and 27 are directed to microstructures made out of surface micromachining micro-fabrication methodology, whereby the whole monolithically structure is made out of silicon and does not require bonding (as described by Burns and Unger) or assembly (as described by Kohlhaas). A single entry port (as in contrast to Burns) is required and a single exit port. The fluid receives an increase in its momentum by a mechanically moving microstructure as in contrast to Burns and Unger.

Unger is directed to a method of fabricating an elastomeric pump formed from a plurality of layers. In particular, *Unger* discloses that the elastomeric structure may be formed from first and second elastomeric layers that are bonded together. As stated in paragraph [0012],

> the present monolithic elastomeric structures are constructed by bonding together two separate layers of elastomer with each layer first being separately cast from a micromachined mold. Preferably, the elastomer used is a two-component addition cure material in which the bottom elastomer layer has an excess of one component, while the top elastomeric layer has an excess of another component. In an exemplary embodiment, **the elastomer used is silicone rubber**. Two layers of elastomer are cured separately. Each layer is separately cured before the top layer is positioned on the bottom layer. The

> two layers are then **bonded** together . . . . This creates a monolithic three-dimensional patterned structure composed entirely of two layers of bonded together elastomer.

Independent claims 1, 15 and 27 are directed to a microstructures that impose mechanical momentum to the fluid and is formed from "a monolithic body formed from a single material." In contrast, *Unger* discloses a micropump formed from layers formed from a first material and a bonding agent used to bond the layers together. Thus, *Unger* discloses a micropump formed from multiple materials. In contrast, the claimed micropump is formed from a single material.

Furthermore, *Unger* discloses an elastomer, such a flexible silicone rubber, which provides the pumping action needed for the design disclosed in *Unger*. The pump disclosed in *Unger* works only with a flexible material capable of retaining its original shape when not under a load and flexing when loaded. In contrast, the claimed invention is directed to a pump, which is formed from silicon. Silicon is a hard, rigid material and differs substantially from silicone rubber, which is the material used to form the pump of *Unger*. Silicone disclosed in *Unger* is drastically different from the silicon in the claimed invention. Thus, *Unger* teaches away from the claims invention. Substituting the silicon of the claimed invention with the silicone rubber of *Unger* would not have been obvious to one of ordinary skill in the art upon reading *Unger*.

While *Unger* discloses that the *Unger* pump is a monolithic structure, it is actually a pump that is formed from a plurality of layers of material that are bonded together. Thus, the

structure that is disclosed is a not a monolithic structure, rather, the *Unger* pump is formed from a plurality of monolithic layers bonded together. In sharp contrast, the claimed invention is directed to a monolithic pump formed from a single material. The claimed monolithic pump is formed from a rigid material, silicon, not silicone rubber, as disclosed in *Unger*.

The claimed monolithic pump also utilizes silicon micromachining technology to create a fully intact pump along with its actuator on a silicon wafer in batch mode. The ability to create the claimed complex structure on a silicon wafer is by no way obvious based on *Unger* and *Kohlhaas*. For example, *Unger* uses two layer structures to make plastic envelopes, and *Kohlhaas* discloses a fuel pump for a vehicle formed from plastic and an undisclosed material. Neither *Unger* nor *Kohlhaas* discloses silicon surface micromachining, as used to create the claimed invention. Utilizing silicon surface micromachining to produce mechanical pumps such as the one disclosed is not obvious. In particular, surface micromachining integrates all in one piece, i.e. the pumping, the channels, the inlets, outlets and the actuator and the connections to power all on the monolithic silicon piece, which is different from the pumps disclosed in *Unger* and *Kohlhaas*. In addition, the silicon surface micromachining is batch printing/removing in which all designs undergo the same processes at the same time. The silicon surface micromachining process also creates all pump components at the same time and maintains connectivity with the actuator while eliminating leakage. Thus, neither *Unger* nor *Kohlhaas* taken singularly or collectively disclose or render obvious the claimed invention. Therefore, the Examiner is respectfully requested to

withdraw the rejection.

The Examiner also rejected claims 10-12, 24-26 and 31 under 35 U.S.C. §103(a) as being unpatentable over Burns et al 6,379,929 in view of *Unger* in view of *Kohlhaas* and further in view of United States Patent No. 5,955,801 to *Romero et al.* The Examiner stated that *Unger* and *Kohlhaas* in combination disclose the claimed invention except for the electrostatic comb drive, which the Examiner stated was disclosed in *Romero et al.* Claims 10-12, 24-26 and 31 depend from the independent claims 1, 15 and 27, which are allowable for the reasons previously set forth.

CONCLUSION

For at least the reasons given above, claims 1-4, 10-12, 15-17, 24-29 and 31 define patentable subject matter and are thus allowable. Should the Examiner believe that anything further is necessary in order to place the application in better condition for allowance, the Examiner is respectfully requested to contact the undersigned representative at the telephone number listed below.

No fees in addition to the extension of time fee are believed due; however the inventor will cover additional cost prescribed by the Commissioner.

Respectfully submitted,

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